COMP9321:
Data services engineering

RESTful Services

Semester 2, 2018,

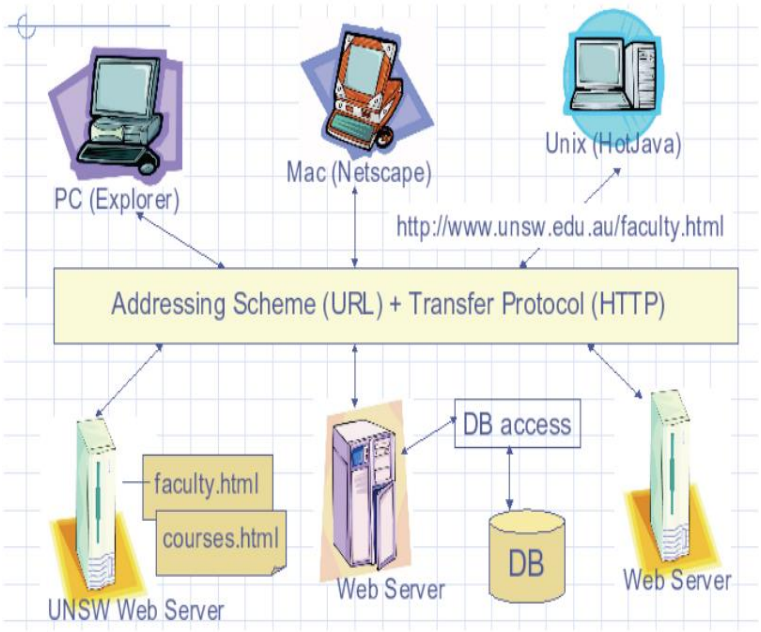
By Mortada Al-Banna, CSE UNSW

Web Essentials

Web = Higher Level Protocol over the Internet

Three basic components of the Web:

- A Uniform Notation Scheme for addressing resources (Uniform Resource Locator - URL)
- A protocol for transporting messages (HyperText Transport Protocol - HTTP)
- A markup language for formatting hypertext documents (HyperText Markup Language – HTML)

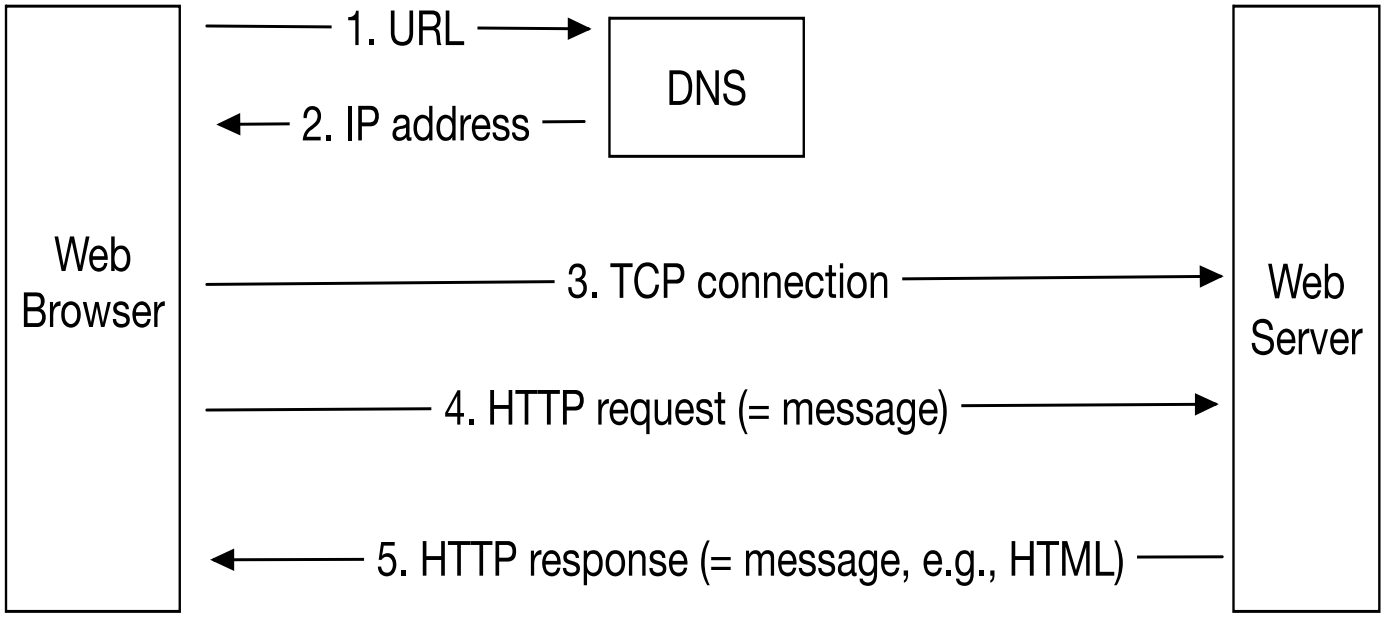


In the end, these building blocks become the essentials of the Web applications as well.

Web Essentials

The building blocks of the Web

A Typical “Web” Interaction (all components together)



The basic “Web” communication model is HTTP request-response (blocked!)

An URL (HTTP scheme)

`http://www.example.org:56789/a/b/c.txt?t=win&s=chess#para5`

authority part:

- after 'http://' through to the next slash - www.example.org:56789
- It consists of either a domain name or an IP address
- optionally followed by a port number (if omitted, port 80 is implied)

path part:

- after the authority through to question mark (?)
- /a/b/c.txt (/ is part of the path, ? is not)
- much like a file path in file system ...

query string part:

- after the path up to a number sign #
- contains a set of name-value pairs, separated by & (e.g., t=win&s=chess)

fragment identifier part:

- after the number sign #, not including #

UNSW SYDNEY

Web Essentials - HTTP

HTTP Request (from browser to server):

It is composed of `Request Line + Header + (additional data)`

Syntax for the Request Line:

`Request-Method sp Request-URI sp HTTP-version CRLF`

eg, GET `http://www.smh.com.au/index.html` HTTP/1.1

- There must be a newline (CRLF) between the header and the additional data part.
- Common Request methods: GET, POST, HEAD ...
- Request header: `User-Agent`, `Referer`, `Authorization`.
- Additional data (body): parameters (POST), block of data

You can utilise many parts of these HTTP request data to be more effective

UNSW SYDNEY

HTTP Request Methods (version 1.1)

Method	Description
GET	It the simplest, most used. It simply retrieves the data identified by the URL. If the URL refers to a script (CGI, servlet, and so on), it returns the data produced by the script.
HEAD	It only returns HTTP headers without the document body.
POST	It is like GET. Typically, POST is used in HTML forms. POST is used to transfer a block of data to the server.
OPTIONS	It is used to query a server about the capabilities it provides. Queries can be general or specific to a particular resource.
PUT	It stores the body at the location specified by the URI. It is similar to the PUT function in FTP.
DELETE	It is used to delete a document from the server. The document to be deleted is indicated in the URI section of the request.
TRACE	It is used to tract the path of a request through firewall and multiple proxy servers. TRACE is useful for debugging complex network problems and is similar to the traceroute tool.

UNSW SYDNEY

Web Essentials - HTTP

HTTP Response (from server to browser):

- Composed of `Status Line + Header + Body`
- Status line: 200 OK, 404 Not Found, etc.
- Header:
  - Content-Type, Content-Language, Content-Length, Cache-control, etc.
- Body:
  - Body contains the requested data
  - Body is in specific MIME format (eg., text/HTML)
  - MIME (Multipurpose Internet Mail Extension): text (plain, HTML), multimedia data, applications such as PDF, PowerPoint, etc.

UNSW SYDNEY

HTTP Status Code: classes/common codes

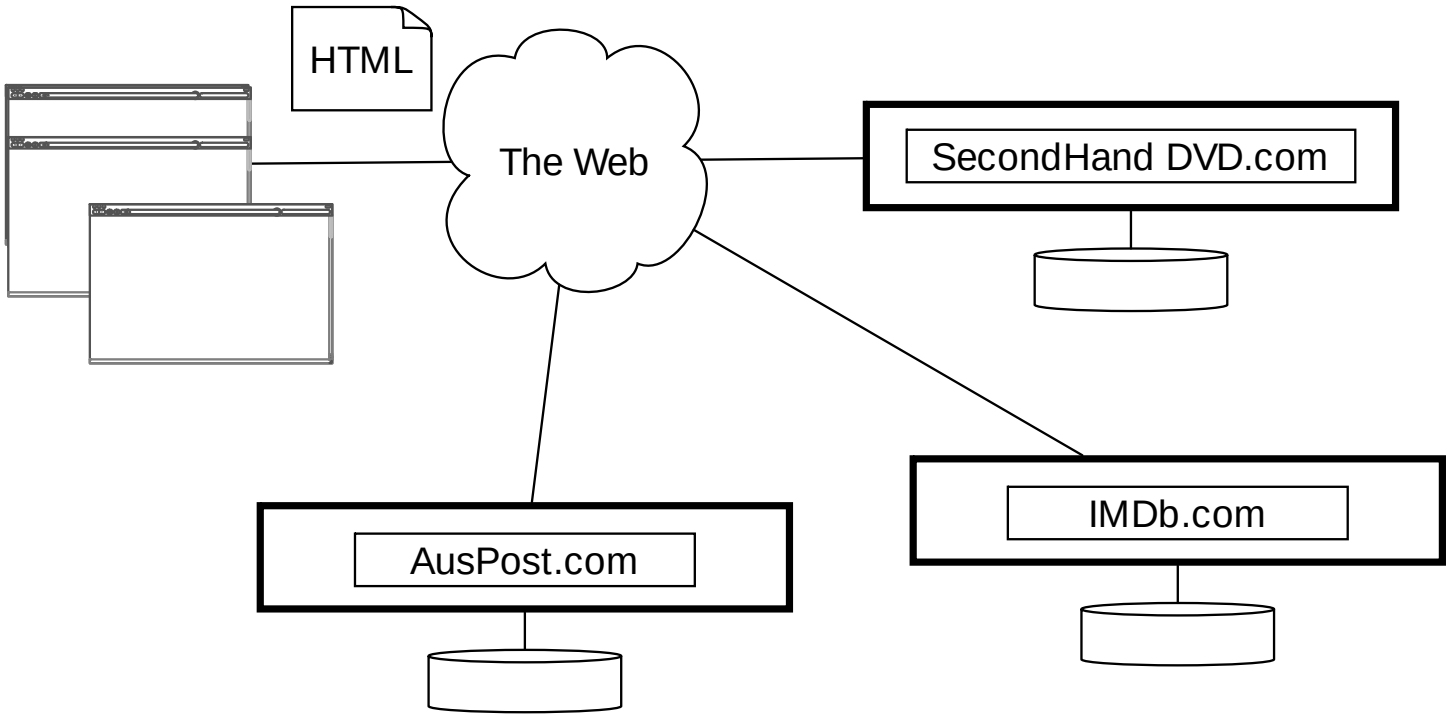
Digit	Class	Standard Use
1	Informational	Provides information to client before request processing has been completed
2	Success	Request has been successfully processed
3	Redirection	Client needs to use a different resource to fulfill request
4	Client Error	Client's request is not valid
5	Server Error	An error occurred during server processing

Code	Reason Phrase	Usual Meaning
200	OK	Request processed normally
301	Moved Permanently	URI for the requested resource has changed
401	Unauthorised	The resource is password protected, and the user has not yet supplied a valid password
403	Forbidden	The resource is present on the server, but is read protected
404	Not Found	No resource corresponding the URI was found
500	Internal Server Error	Server software detected an internal failure

UNSW SYDNEY

Back to the story of integrating applications

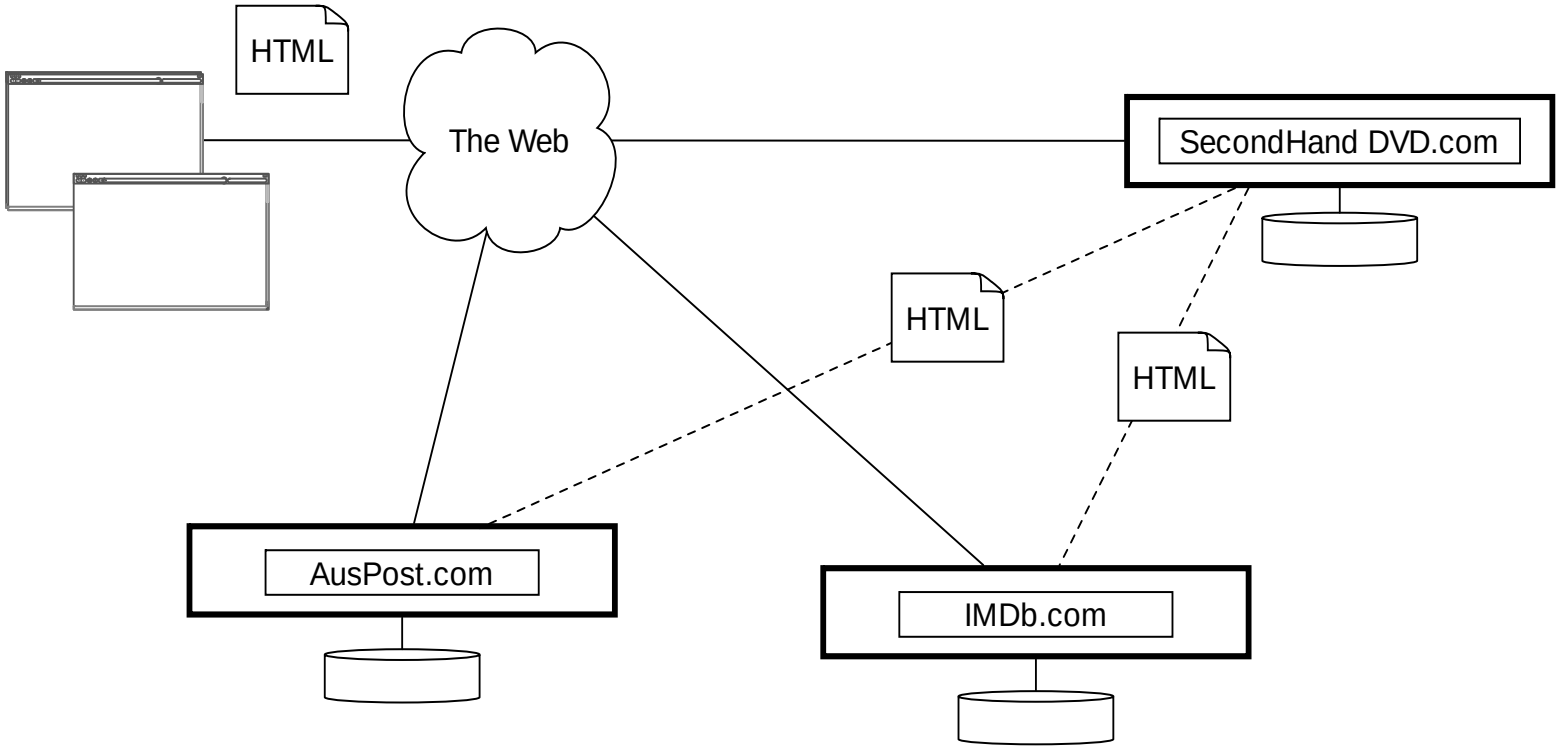
Over the last 20 years, we have built a lot of Web sites!



UNSW SYDNEY

Story of Web APIs

Web sites in early 2000 were pretty much 1-Tier system from the application integration standpoint



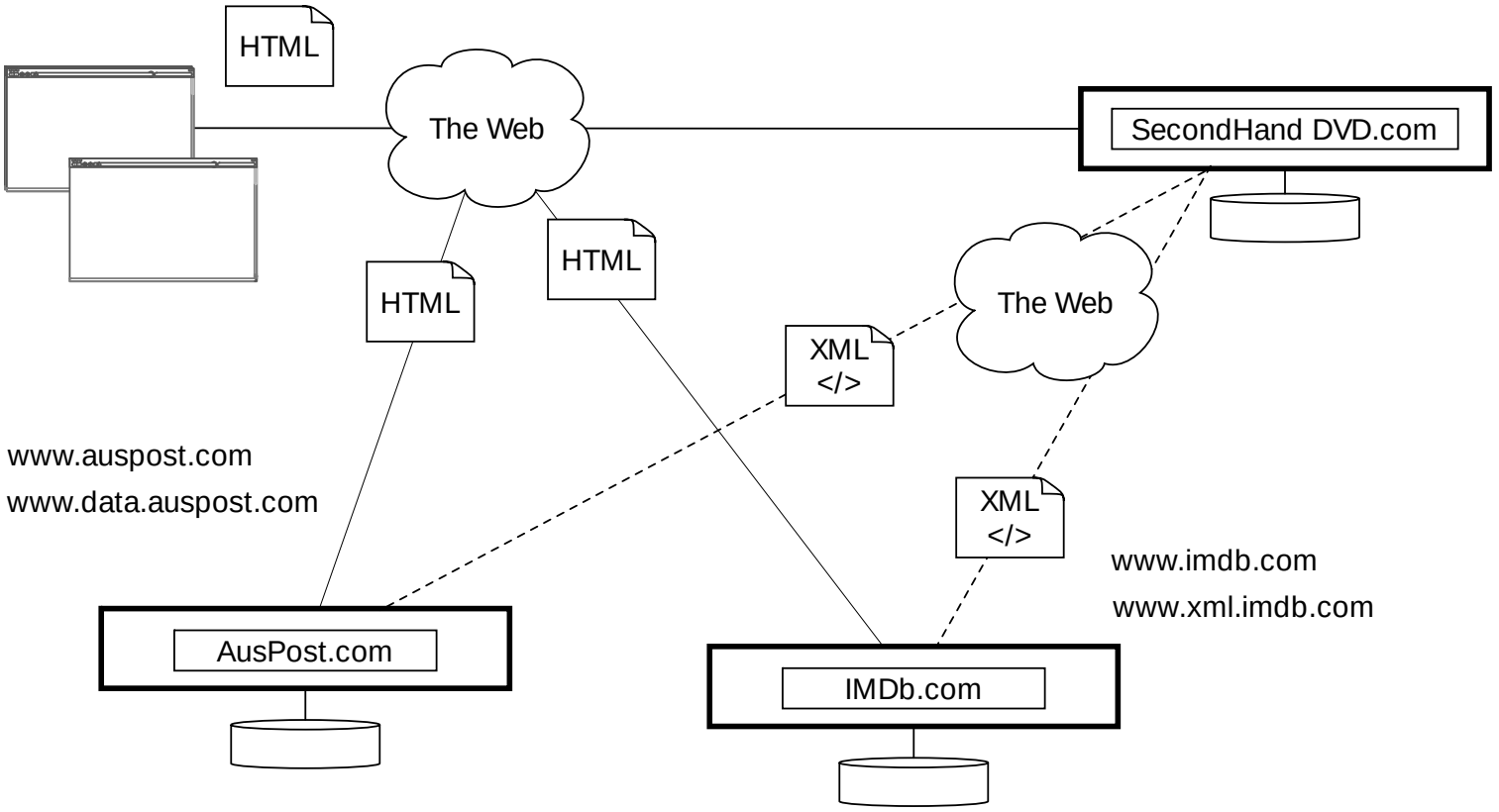
Faking browser clicks (requests) – HTTP/HTML interactions

Brittle … the sources can change without you.

UNSW SYDNEY

Story of Web APIs

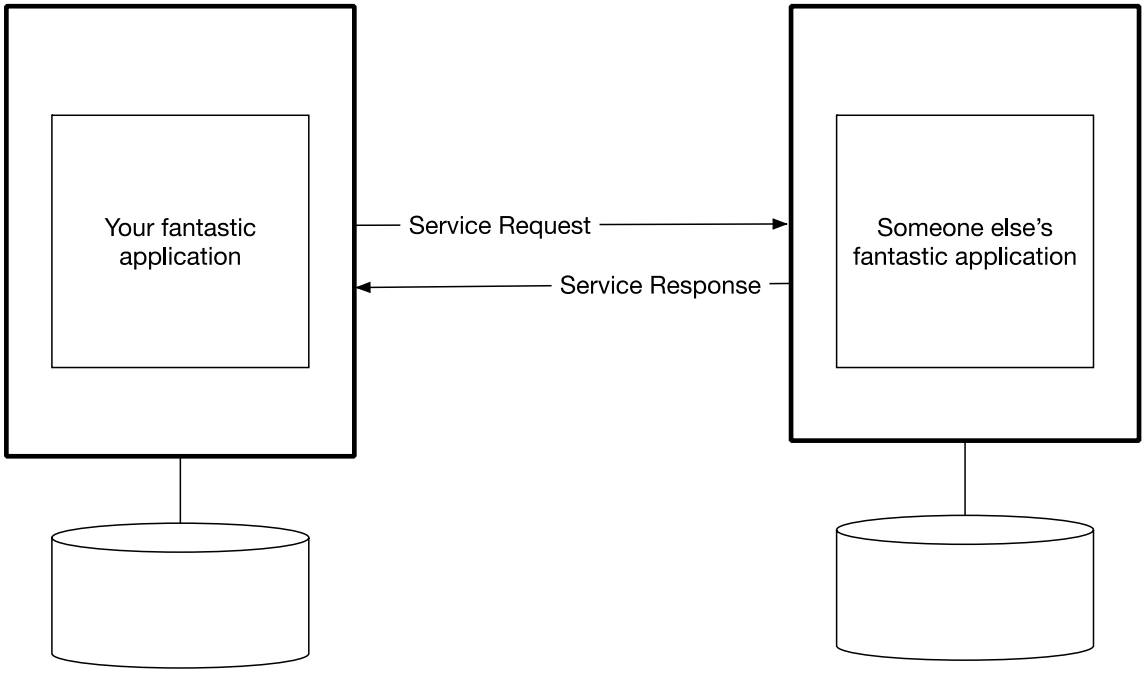
A better version of the idea …



Development of an idea that software-to-software interactions are to be treated differently.

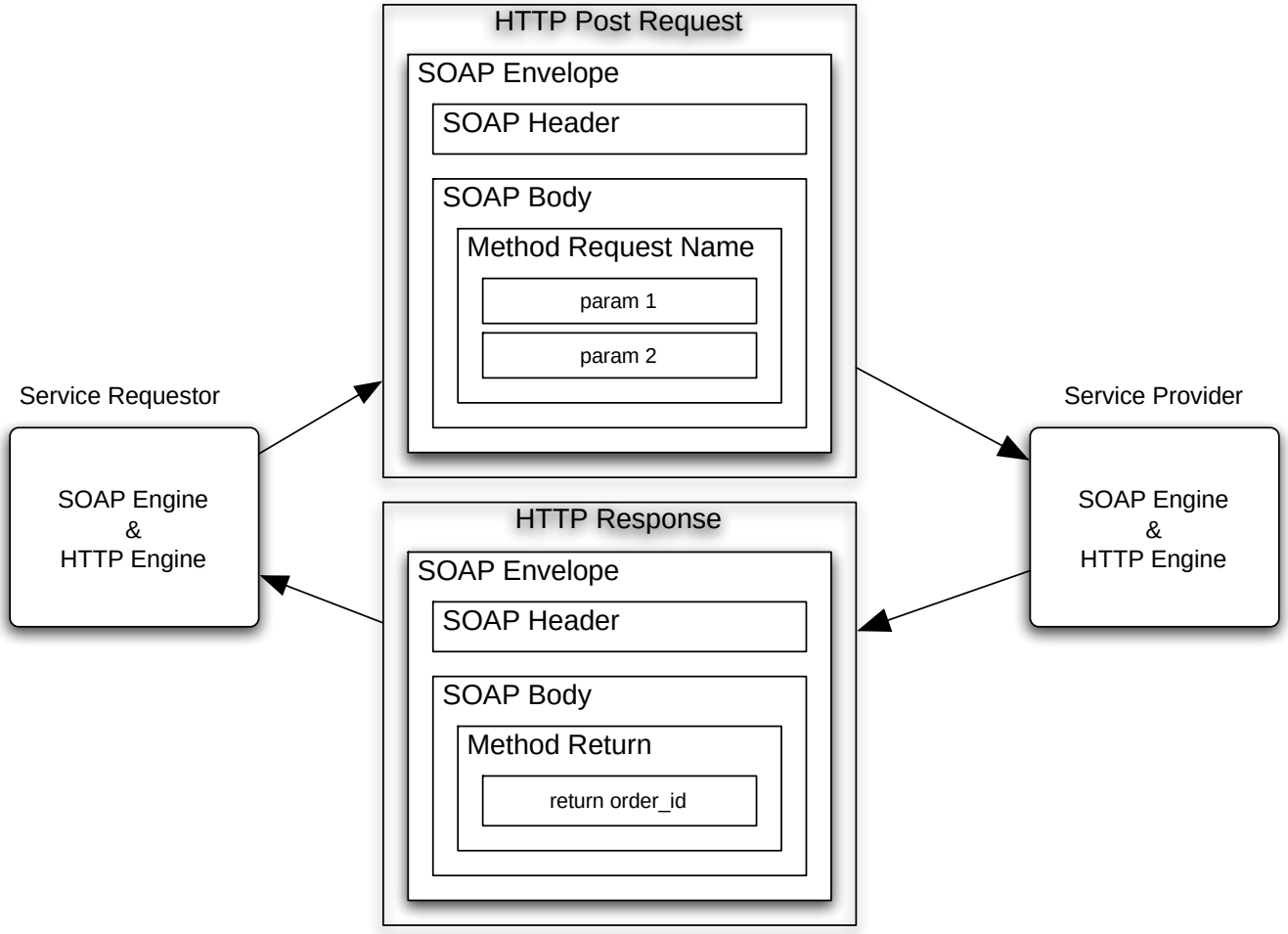
UNSW SYDNEY

API – Application Programming Interface



- The interface is not meant for human interactions – there is another program on the other side → implication of this: you must have a clear contract (e.g., IOU Alice Bob 100)
- These days companies use APIs internally (private APIs) as well as exposing them externally (public APIs)

XML-based APIs …



Early versions of API utilised XML documents → SOAP protocol (W3C standards), or XmlRPC

XML-based APIs …

Couple of SOAP examples:
http://www.dneonline.com/calculator.asmx
http://www.webservicex.net/stockquote.asmx/

```
POST /StockQuote HTTP/1.1
Host: www.stockquoteserver.com
Content-Type: text/xml; charset="utf-8"
Content-Length: nnnn
SOAPAction: "Some-URI"

<SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
   <SOAP-ENV:Body>
       <m:GetLastTradePrice xmlns:m="Some-URI">
           <symbol>DIS</symbol>
       </m:GetLastTradePrice>
   </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

```
HTTP/1.1 200 OK
Content-Type: text/xml; charset="utf-8"
Content-Length: nnnn

<SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"/>
   <SOAP-ENV:Body>
       <m:GetLastTradePriceResponse xmlns:m="Some-URI">
         <Price>34.5</Price>
       </m:GetLastTradePriceResponse>
   </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Use HTTP as the ‘carrier’ of a tightly-constructed messages

http://www.webservicex.net/stockquote.asmx (Web Service Description Language)

UNSW SYDNEY

Now JSON/REST is ‘preferred’ choice

GET /stockquote/DIS HTTP/1.1
Host: www.stockquoteserer.com
Accept: application/json

HTTP/1.1 200 OK
Content-Type: application/json
Content-Length: xxx

```
{
  “ticker”: “DIS”,
  “price”: 34.5
}
```

Let’s deconstruct this idea in detail …

UNSW SYDNEY

What is and Why a RESTful Service

Early XML-based API fell out of favour along with the rise of the number of ‘mobile’ devices (and other ‘non-traditional’ client devices) due to the ‘heavy’ data payload and processing load

REST is an architectural style of building networked systems - a set of architectural constraints in a protocol built in that style.

The protocol in REST is HTTP (the core technology that drives the Web)

Popular form of API ... It is popularised as a guide to build modern distributed applications on the Web – let’s work with the components that the Web itself is built in.

REST itself is not an official standard specification or even a recommendation. It is just a “design guideline” for building a system (or a service in our context) on the Web

UNSW SYDNEY

REST – REpresentational State Transfer

(of resources)

- https://www.youtube.com/watch?v=w5j2KwzzB-0
- http://www.ics.uci.edu/~fielding/pubs/dissertation/top.htm

UNSW SYDNEY

Resources in REST

In REST, everything starts and ends with resources (the fundamental unit).

What is a Resource?

The key abstraction of information in REST is a resource. Any information that can be named can be a resource: a document or image, a temporal service (e.g. today's weather in Los Angeles), a collection of other resources, a non-virtual object (e.g. a person), and so on. In other words, any concept that might be the target of an author's hypertext reference must fit within the definition of a resource. – Roy Fielding's dissertation.

UNSW SYDNEY

Resources and Representational States

What is a Resource? (more concretely …)

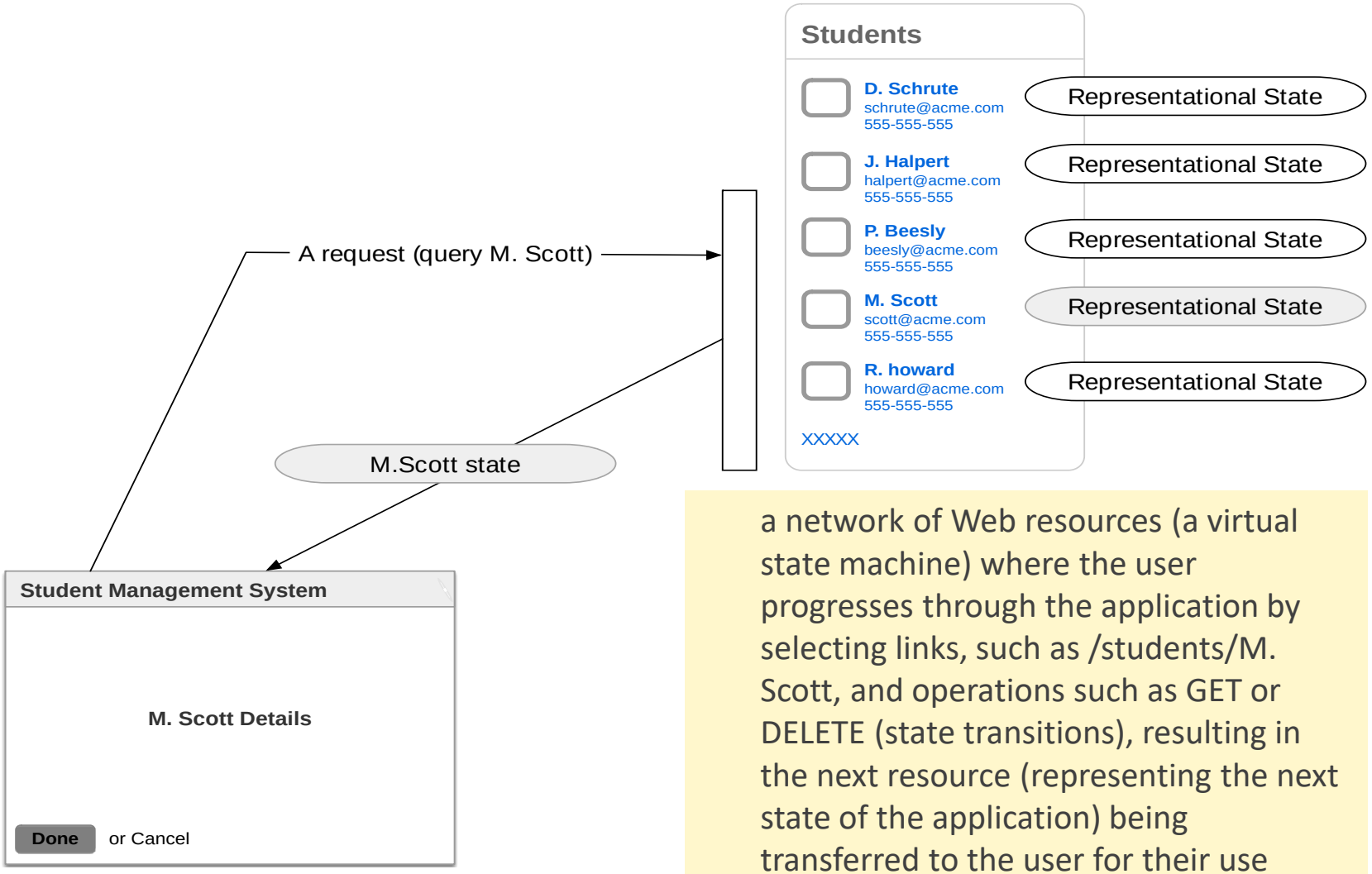
A resource is a thing that:

- is unique (i.e., can be identified uniquely)
- has at least one representation
- has one or more attributes beyond ID
- has a potential schema, or definition
- can provide context (state) – which can change (updated)
- is reachable within the addressable universe
- collections, relationships

e.g., Students, Courses, Program

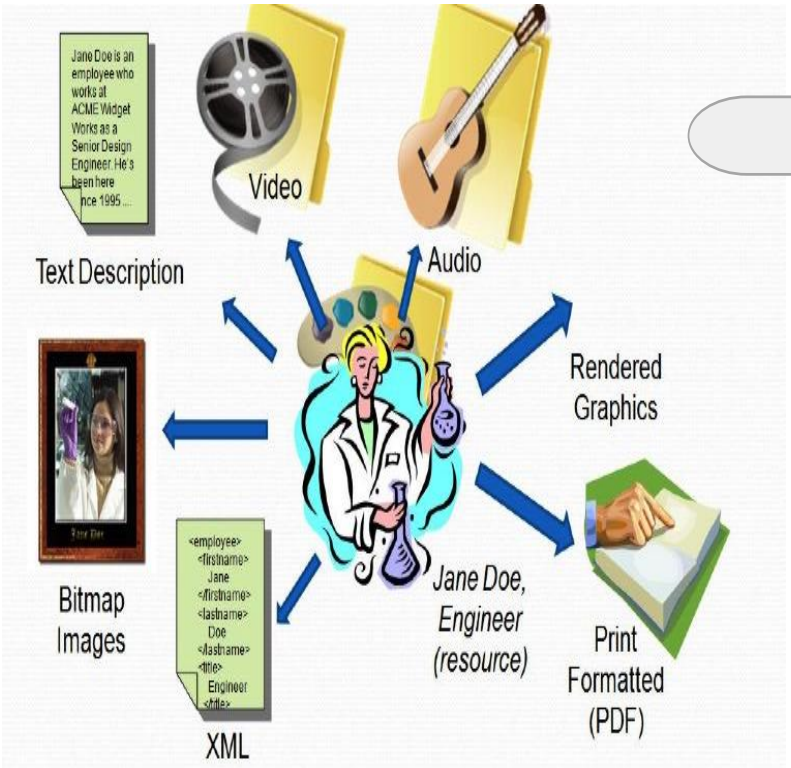
UNSW SYDNEY

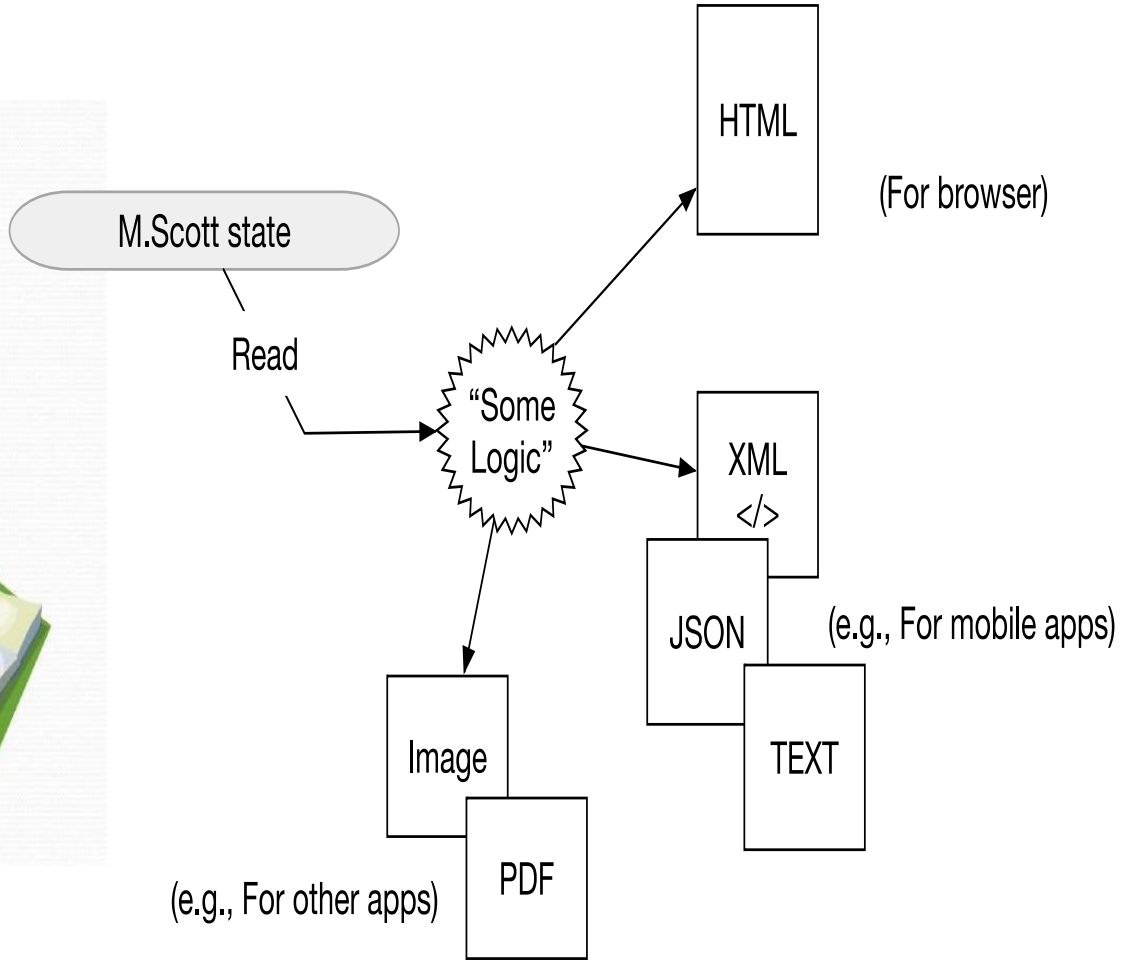
Representational State Transfer



a network of Web resources (a virtual state machine) where the user progresses through the application by selecting links, such as /students/M. Scott, and operations such as GET or DELETE (state transitions), resulting in the next resource (representing the next state of the application) being transferred to the user for their use

Resource's Multiple Representations





Based on the needs of the consumer … (REST principles do not specify "standard data format")

What makes a RESTful Service?

REST is an architectural style of building networked systems - a set of architectural constraints in a protocol built in that style.

A RESTful service/API MUST meet the architectural constraints by following the design guide/principles (i.e., you can say what is and is not RESTful)

UNSW SYDNEY

Architectural Constraints of REST

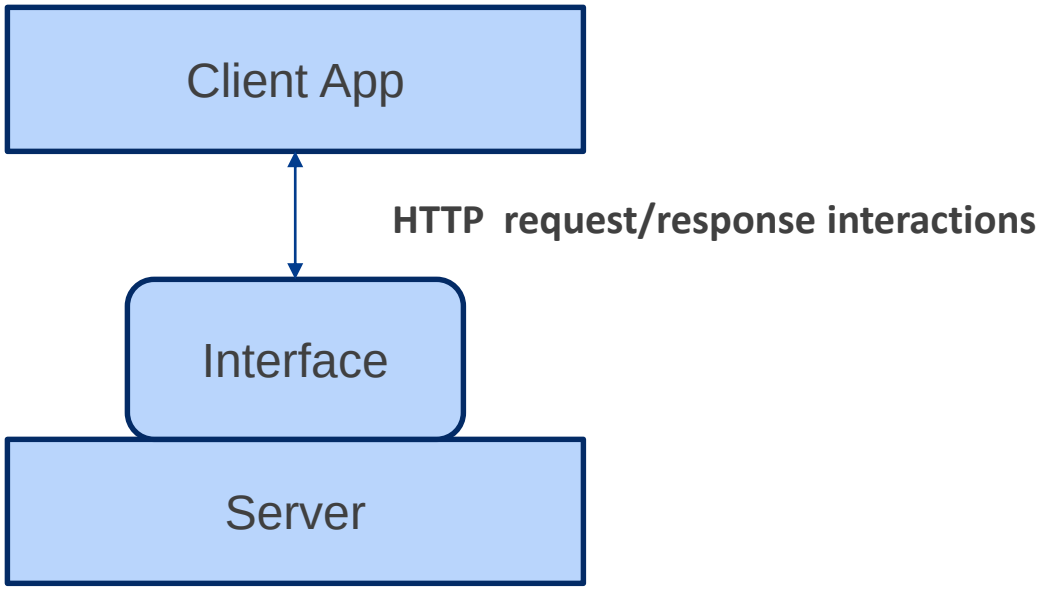
1. Client-Server
2. Uniform Interface
3. Statelessness
4. Caching
5. Layered System
6. Code on demand (optional)

If your design satisfies the first five, you can say your API is ‘RESTful’

UNSW SYDNEY

Client-Server

1. **Client-Server**
2. Uniform Interface
3. Statelessness
4. Caching
5. Layered System



The same idea as the classic two-tier architecture, foundation of REST architecture.

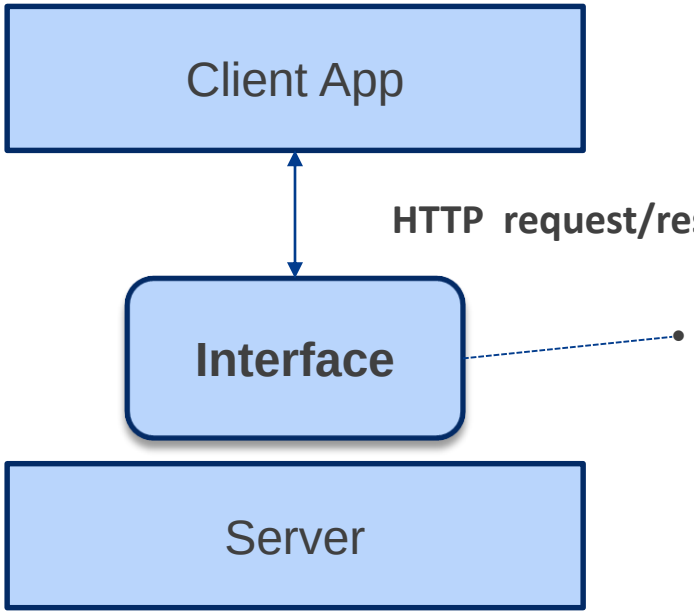
Server-side (business logic layer and beyond) is physically separated from the client app

WHY good thing? – separation of concerns, they can evolve without affecting each other

- Server-side: performance, scaling, data management, data security, etc.
- Client App: user experience, multiple form factor/devices support, etc.

Uniform Interface

1. Client-Server
2. **Uniform Interface**
3. Statelessness
4. Caching
5. Layered System



- **UNIFORM INTERFACE**
  - **Uniform ≈ "Common" in All RESTful interface**
  - **Contract for communication btw C-S**
  - **Described using HTTP methods and Media Type only**

REST design principles go into how to design the interface to meet the constraint.

UNSW SYDNEY

On Uniform Interface – Resource URI

Resources are identified by a URI (Uniform Resource Identifier)

A resource has to have at least one URI

Most well-known URI types are URL and URN

- URN (Uniform Resource Name)
  - urn:isbn:0-486-27557-4 (Shakespeare's Romeo and Juliet book)
  - urn:isan:0000-0000-9E59-0000-O-0000-0000-2 (2002 spider man film)

- URL (Uniform Resource Locator)
  - file:///home/tommy/plays/RomeoAndJuliet.pdf
  - http://home/tommy/plays/RomeoAndJuliet.html

Every URI designates exactly one resource

- http://www.example.com/software/releases/1.0.3.tar.gz
- http://www.example.com/software/releases/latest

UNSW SYDNEY

On Uniform Interface - Addressability

The resources must be addressable

An application is ‘addressable’ if it exposes its data set as resources (i.e., usually a large number of URIs)

- File system on your computer is addressable system
- The cells in a spreadsheet are addressable (cell referencing)

flickr – a good example of “addressable” Web
you can bookmark, use it as link in a program, you can email, etc.

Systems that are not addressable ?

REST advocates identification and addressability of resources as a main feature of the Uniform Interface constraint

On Uniform Interface - Representations

A resource needs a representation for it to be sent to the client

a representation of a resource - some data about the ’current state’ of a resource

E.g., On some software project, a list of open bugs can have representations in :–

- an XML file,
- a web page,
- comma-separate-values,
- printer-friendly-format, etc.

when a representation of a resource may also contain metadata about the resource (e.g., books: book itself + metadata such as cover-image, reviews, other related books) - relationships.

Representations can flow the other way too: a client send a new or updated ’representation’ of a resource and the server creates/updates the resource.

UNSW SYDNEY

On Uniform Interface - Representations

And … you shall provide multiple representations …

Deciding between multiple representations

Option 1.

Have a distinct URI for each representation of a resource:

- http://www.example.com/release_doc/104.en (English)
- http://www.example.com/release_doc/104.es (Spanish)
- http://www.example.com/release_doc/104.fr (French)

Looks very “addressable” → good!

UNSW SYDNEY

On Uniform Interface - Representations

Deciding between multiple representations

Option 2.

Use HTTP HEAD (metadata) for content negotiation:

Expose a single URL: http://www.example.com/release_doc/104

Client HTTP request contains Accept-Language

Content Negotiation (part of HTTP spec)

Other types of request metadata can be set to indicate all kinds of client preferences,

e.g., file format, payment information, authentication credentials, IP address of the client, caching directives, and so on.

Option 1 or 2 are both acceptable REST-based solution ...

UNSW SYDNEY

On Uniform Interface – Description Syntax

Use pure HTTP methods as main operations on resources

What HTTP Spec says about the following methods:

GET: Retrieve a representation of a resource.

PUT: Create a new resource (new URI) or update a resource (existing URI)

DELETE: Clear a resource, after the URI is no longer valid

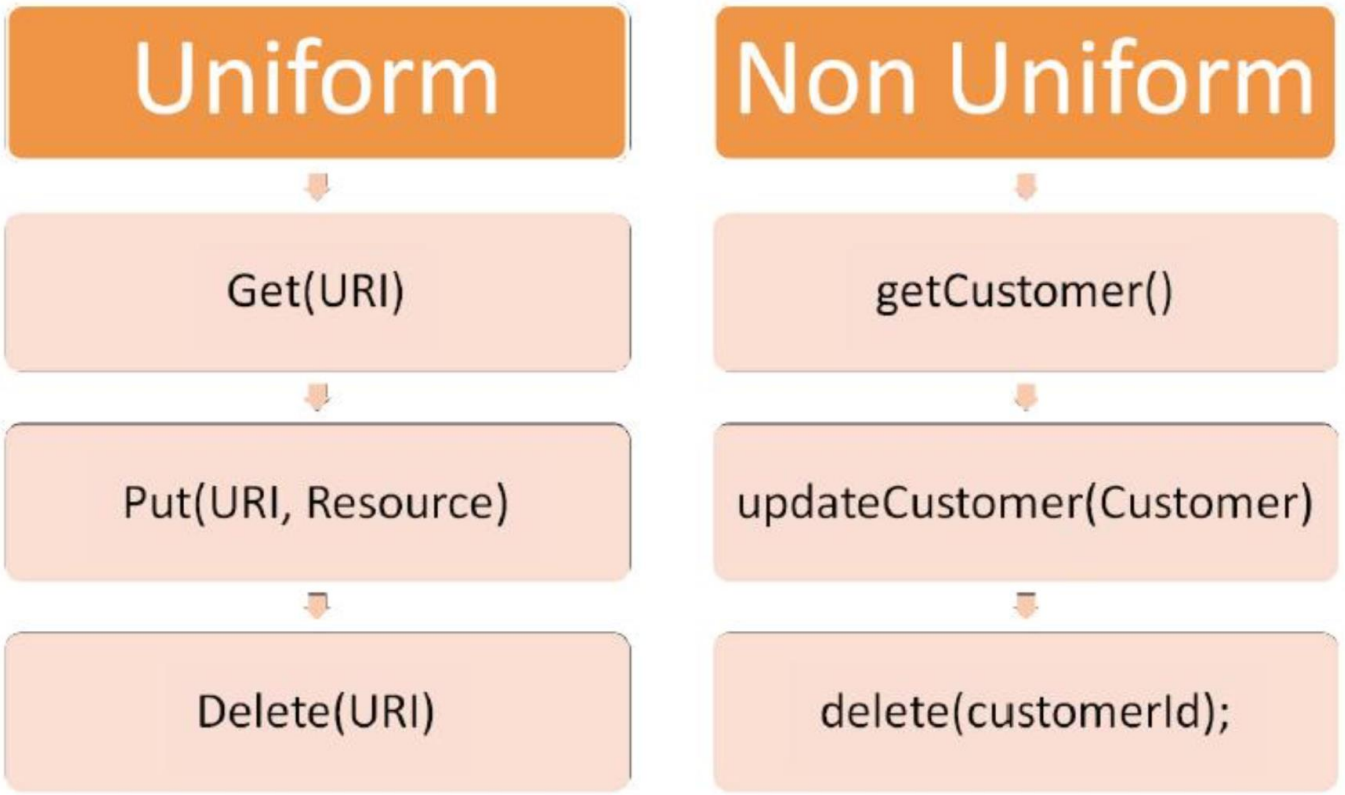
POST*: Modify the state of a resource. POST is a read-write operation and may change the state of the resource and provoke side effects on the server. Web browsers warn you when refreshing a page generated with POST.

HEAD, OPTIONS and PATCH

Similar to the CRUD (Create, Read, Update, Delete) databases operations *POST: a debate about its exact best-practice usage ...

UNSW SYDNEY

On Uniform Interface – “Uniform” Interface



UNSW SYDNEY

On Uniform Interface – Description Syntax

Given a resource (coffee order): a representation in XML

```
<order>
    <drink>latte</drink>
</order>
```

What HTTP Spec says about the input/output of the following methods. What does the following operations mean and what do they return?

POST /starbucks/orders

GET /starbucks/orders/order?id=1234

PUT /starbucks/orders/order?id=1234

DELETE /starbucks/orders/order?id=1234

UNSW SYDNEY

On Uniform Interface - POST and PUT

POST creates a new resource

- But ... the server decides on that resource's URI and returns the new URI for the resource in the response
- Common examples: creating a new employee, a new order, a new blog posting, etc.

PUT "creates" or "updates" a resource:

- But ... the URI is given in the request input by client
- if existing, the contained entity is considered as a modified version of the resource ...

Generally, POST to create, PUT to update ...

UNSW SYDNEY

On Uniform Interface - PUT and PATCH

PATCH is added later in the HTTP spec to support “partial updates” of a resource:

HTTP spec says: In a PUT request, the enclosed entity is considered to be a modified version of the resource stored on the origin server, and the client is requesting that the stored version be replaced. With PATCH, however, the enclosed entity contains a set of instructions describing how a resource currently residing on the origin server should be modified to produce a new version.

PATCH /students/0001 [{ "op": "replace", "path": "/DOB", "value": "12/12/1990" }]

Neither safe nor idempotent ...

UNSW SYDNEY

On Uniform Interface – Safe & Idempotent

Uniform Interface must be safe and idemponent

- *Being Safe*

Read-only operations ... The operations on a resource do not change any server state. The client can call the operations 10 times, it has no effect on the server state.

(like multiplying a number by 1, e.g., 4x1, 4x1x1, 4x1x1x1, ...)

- *Being Idempotent*

Operations that have the same “effect” whether you apply it once or more than once. An effect here may well be a change of server state. An operation on a resource is idempotent if making one request is the same as making a series of identical requests.

(like multiplying a number by 0, e.g., 4x0, 4x0x0, 4x0x0x0, ...)

UNSW SYDNEY

On Uniform Interface – Safe & Idempotent

Safety and Idempotency

- GET: safe (and idempotent)
- HEAD and OPTION: safe

- PUT: - idempotent
  - If you create a resource with PUT, and then resend the PUT request, the resource is still there and it has the same properties you gave it when you created it.
    If you update a resource with PUT, you can resend the PUT request and the resource state won't change again
- DELETE: - idempotent
  - If you delete a resource with DELETE, it's gone. You send DELETE again, it is still gone !

What about POST?

UNSW SYDNEY

On Uniform Interface – Safety & Idempotent

Why Safety and Idempotency matter:

The two properties let a client make reliable HTTP requests over an unreliable network.

Your GET request gets no response? make another one. It's safe.

Your PUT request gets no response, make another one. Even if your earlier one got through, your second PUT will have no side-effect

There are many applications that misuse the HTTP uniform interface. e.g.,

- GET https://api.del.icio.us/posts/delete
- GET www.example.com/registration?new=true&uname=John&passwd=123

Many expose unsafe operations as GET and there are many use of POST operation which is neither safe nor idempotent. Repeating them has consequences ...

UNSW SYDNEY

On Uniform Interface – Safe & Idempotent

Why Safety and Idempotency matter

Allows the “Uniformity” in REST interface (≈ accepted convention by the community)

The point about REST Uniform Interface is in the ’uniformity’: that every service uses HTTP’s interface the same way.

It means, for example, GET does mean ’read-only’ across the Web no matter which resource you are using it on.

It means, we do not use methods in place of GET like doSearch or getPage or nextNumber.

It is not just having a method called GET in your service, it is about using it the way it was meant to be used.

UNSW SYDNEY

On Uniform Interface – Linked Resources

Representations are hypermedia: resource (data itself) + links to other resources

e.g., Google Search representation:

On Uniform Interface – Linked Resources

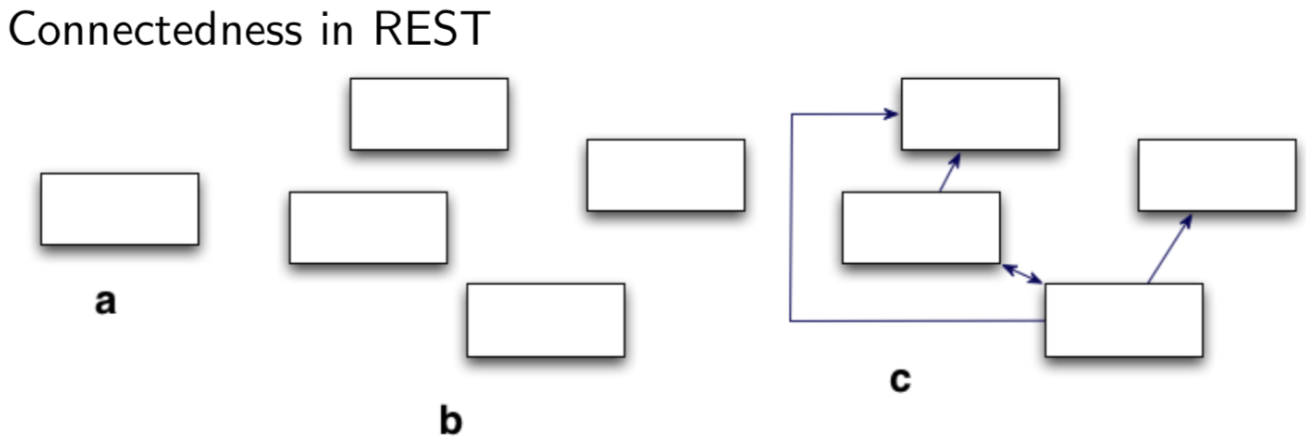
R. Fielding talks about: “Hypermedia as the engine of application state”

The current state of an HTTP ‘session’ is not stored on the server as a resource state, but tracked by the client as an application state, and created by the path the client takes through the Web. The server guides the client’s path by serving hypermedia: links and forms inside resource representations.

The server sends the client guidelines about which states are near and current one.

UNSW SYDNEY

On Uniform Interface – Linked Resources



All three services expose the same functionality, but their usability increases towards the right

- Service A is a typical remote-function style service, exposing everything through a single URI. Neither addressable, nor connected
- Service B is addressable but not connected; there are no indication of the relationships between resources. A hybrid style ...
- Service C is addressable and well-connected; resources are lined to each other in ways that make sense. A fully RESTful service

On Uniform Interface – Linked Resources

Example: Pagination

```
HTTP/1.1 200 OK
{
  "href" : "https://api.mycompany.com/v1/users?offset=50&amp;limit=50"
  "offset": 50,
  "limit": 50,
  “first”: {
      “href”: "https://api.mycompany.com/v1/users"
  },
   “prev”: {
      “href”: "https://api.mycompany.com/v1/users"
  },
  “next”: {
      “href”: "https://api.mycompany.com/v1/users?offset=100&amp;limit=50"
  },
  “last”: {
      “href”: "https://api.mycompany.com/v1/users?offset=50&amp;limit=50"
  },
  "items": [
    {
      … user 51 name/value pairs …
    },
    …,
    {
      … user 100 name/value pairs …
    }
  }
```


https://stormpath.com/blog/linking-and-resource-expansion-rest-api-tips

Statelessness

1. Client-Server
2. Uniform Interface
3. **Statelessness**
4. Caching
5. Layered System

REST API must be stateless

All calls from clients are independent

Stateless means every HTTP request happens in a complete isolation.

Stateless is good !! - scalable, easy to cache, addressable URI can be bookmarked (e.g., 10th page of search results)

HTTP is by nature stateless. We do something to break it in order to build applications

the most common way to break it is 'HTTP sessions'

the first time a user visits your site, he gets a unique string that identifies his session with the site

http://www.example.com/forum?PHPSESSIONID=27314962133
the string is a key into a data structure on the server which contains what the user has been up to. All interactions assume the key to be available to manipulate the data on the server

UNSW SYDNEY

On Statelessness

What counts as ‘state’ exactly?

Think a Flickr.com-like web site ... you will add photos, rename photos, share them with friends, etc. – what would ‘being stateless’ mean here?

KEY notion: **separation of client application state and RESTful resource state.**

- consider the application state as data that could vary by client, and per request.
- consider the resource state as data that could is centrally managed by the server. It is the same for every client.
- resource states live on the server
- individual client application states should be kept off the server

Consider a scenario: a little photo edit app + Flickr and other APIs ...

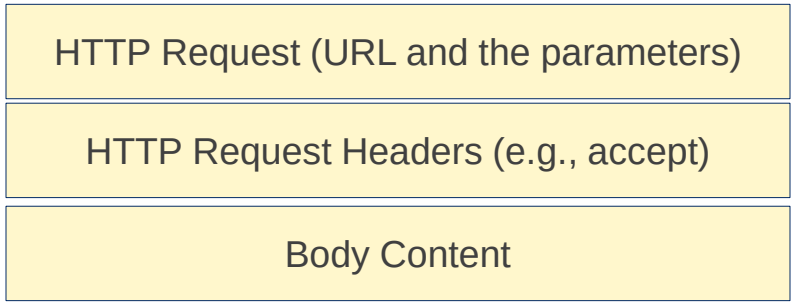
UNSW SYDNEY

On Statelessness

Statelessness in REST applies to the client application state (from the server's view point)

What does this mean to the client application?

- every REST request should be totally self-descriptive
- client transmit the state to the server for every request that needs it.



a RESTful service requires that the application state to stay on the client side. Server does not keep the application state on behalf of a client

What about OAuth? Is it conflicting with the Statelessness of REST?

Caching

1. Client-Server
2. Uniform Interface
3. Statelessness
4. **Caching**
5. Layered System

Responses must be marked ‘cachable’ or ‘non-cachable’

Well-managed caching partially or completely eliminates some client–server interactions, improving scalability and performance.

Being Stateless: every action happens in isolation:

- Keeps the interaction protocol simpler
- But the interactions may become ‘chattier’

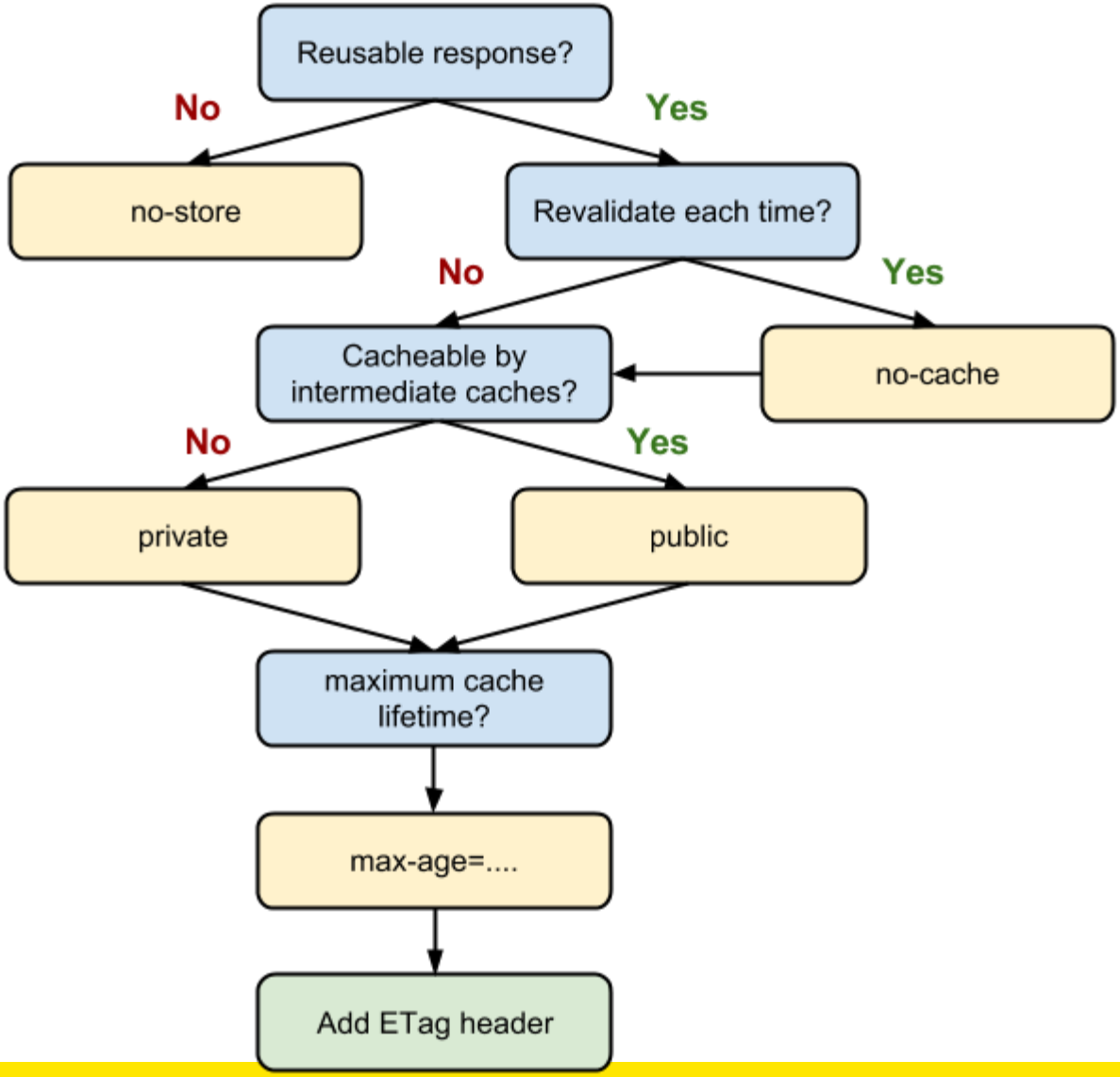
To scale, RESTful API must be work-shy (only generate data traffic when needed, other times use cache)

This requires ’server-client’ collaboration:

- Client provide guard clauses in requests so that servers can determine easily if there’s any work to be done
- If-Modified-Since, Last Modified, If-None-Match/ETag

UNSW SYDNEY

Caching (Defining optimal Cache-Control policy)



https://developers.google.com/web/fundamentals/performance/optimizing-content-efficiency/http-caching?hl=en

UNSW SYDNEY

Caching

Request

```
GET /transactions/debit/1234 HTTP 1.1
Host: bank.example.org
Accept: application/xml
If-None-Match: aabd653b-65d0-74da-bc63-4bca-ba3ef3f50432
```

Response

```
200 OK
Content-Type: application/xml
Content-Length: ...
Last-Modified: 2010-21-04T15:10:32Z
Etag: abbb4828-93ba-567b-6a33-33d374bcad39
<t:debit xmlns:t="http://bank.example.com">
<t:sourceAccount>12345678</t:sourceAccount>
<t:destAccount>987654321</t:destAccount>
<t:amount>299.00</t:amount>
<t:currency>GBP</t:currency>
</t:debit>
```


UNSW SYDNEY

Caching

Request

```
GET /transactions/debit/1234 HTTP 1.1
Host: bank.example.org
Accept: application/xml
If-Modified-Since: 2010-21-04T15:00:34Z
```

Response

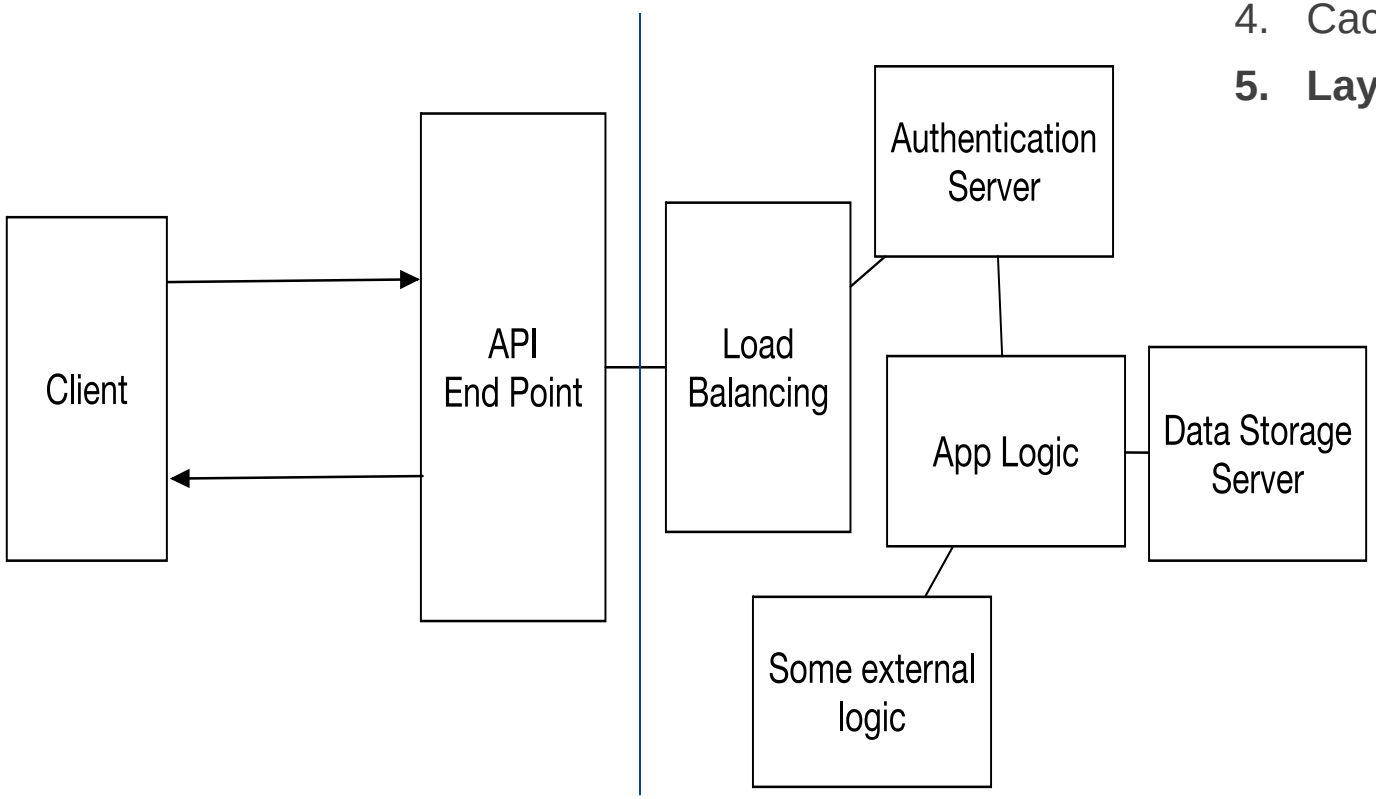
```
200 OK
Content-Type: application/xml
Content-Length: ...
Last-Modified: 2010-21-04T15:00:34Z
```

Server needs cache management policy and implementation …

UNSW SYDNEY

Layered System

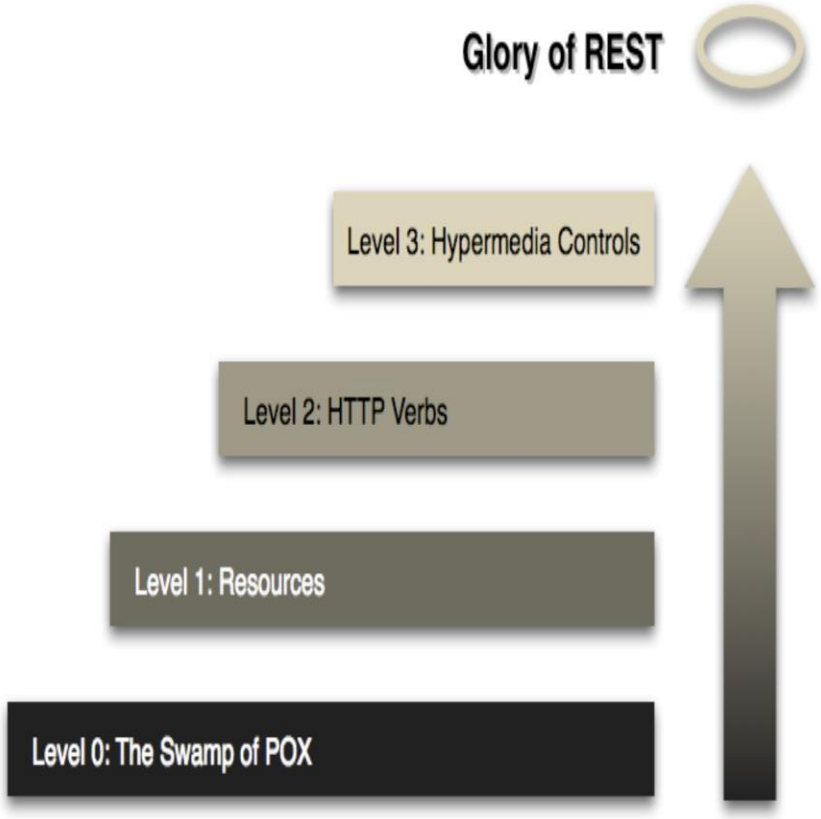
1. Client-Server
2. Uniform Interface
3. Statelessness
4. Caching
5. **Layered System**



A client cannot ordinarily tell whether it is connected directly to the end server, or to an intermediary along the way.

Again, de-coupling allows the components in the architecture to evolve independently

The Richardson Maturity Model



Leonard Richardson: can we measure to what level your service is RESTful?

Level 0: One URI (single endpoint) exposed, requests contain operation details

Level 1: Expose resource URIs - individual URIs for each resource. Requests could still contain some operation details

Level 2: HTTP Methods - use the standard HTTP methods, status codes with the resource URIs,

Level 3: HATEOAS - self-documenting responses, responses include links that the client can use

A good read: https://martinfowler.com/articles/richardsonMaturityModel.html

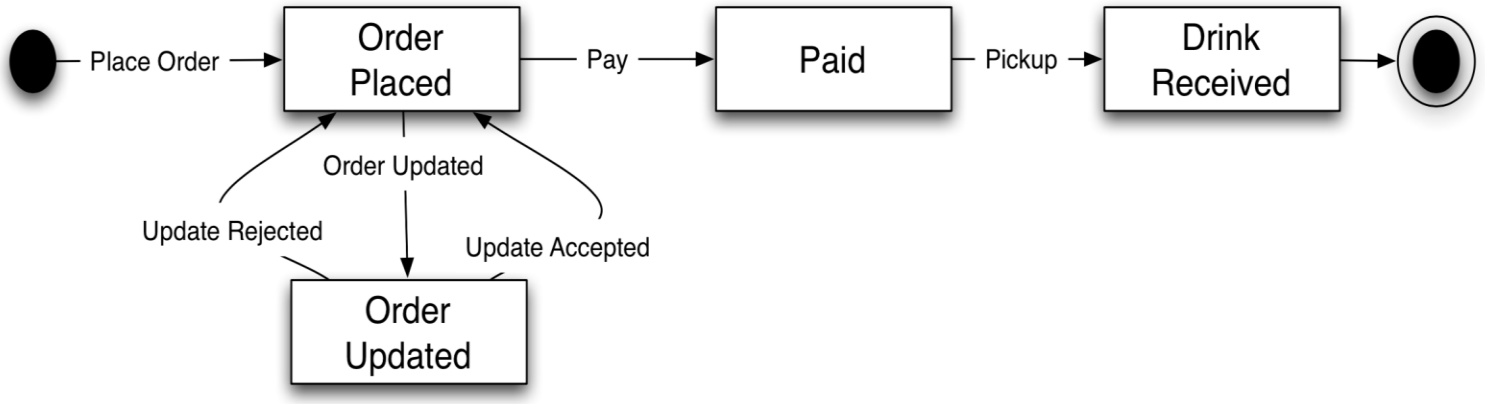
UNSW SYDNEY

Interacting with RESTful API (workflow)

What would it be like to have a stateless conversation with API vs. stateful conversation with API? (e.g., POST -> return ID, forget vs. POST-> return no ID, plant Cookies)

Take the Coffee Order Process from Jim Webber as example ...

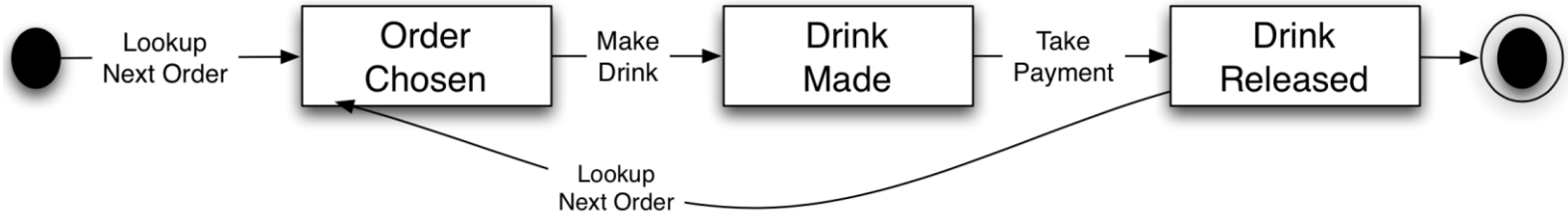
The customer workflow:



customers advance towards the goal of drinking some coffee by interacting with the Starbucks service, the customer orders, pays, and waits for the drink, between ‘order’ and ‘pay’, the customer can update (asking for skimmed milk)

Interacting with RESTful API (workflow)

The barista workflow:



the barista loops around looking for the next order to be made, preparing the drink, and taking the payment,

The outputs of the workflow are available to the customer when the barista finishes the order and releases the drink

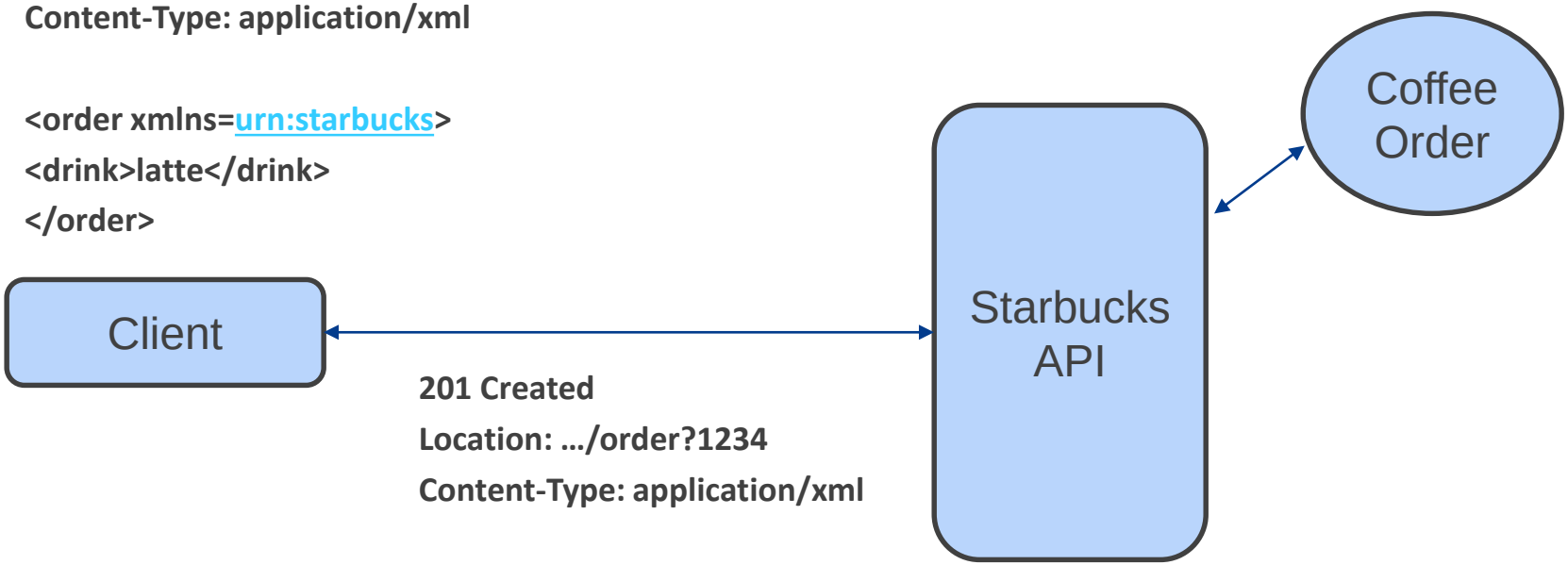
Points to Remember: We will see how each transition in two state machines is implemented as an interaction with a Web resource. Each transition is the combination of a HTTP verb on a resource via its URI causing state changes.

Customer's View Point

Place an order: POST-ing on http://api.starbucks.com/orders

POST /orders HTTP/1.1
Host: xxx
Content-Type: application/xml

<order xmlns=urn:starbucks>
<drink>latte</drink>
</order>



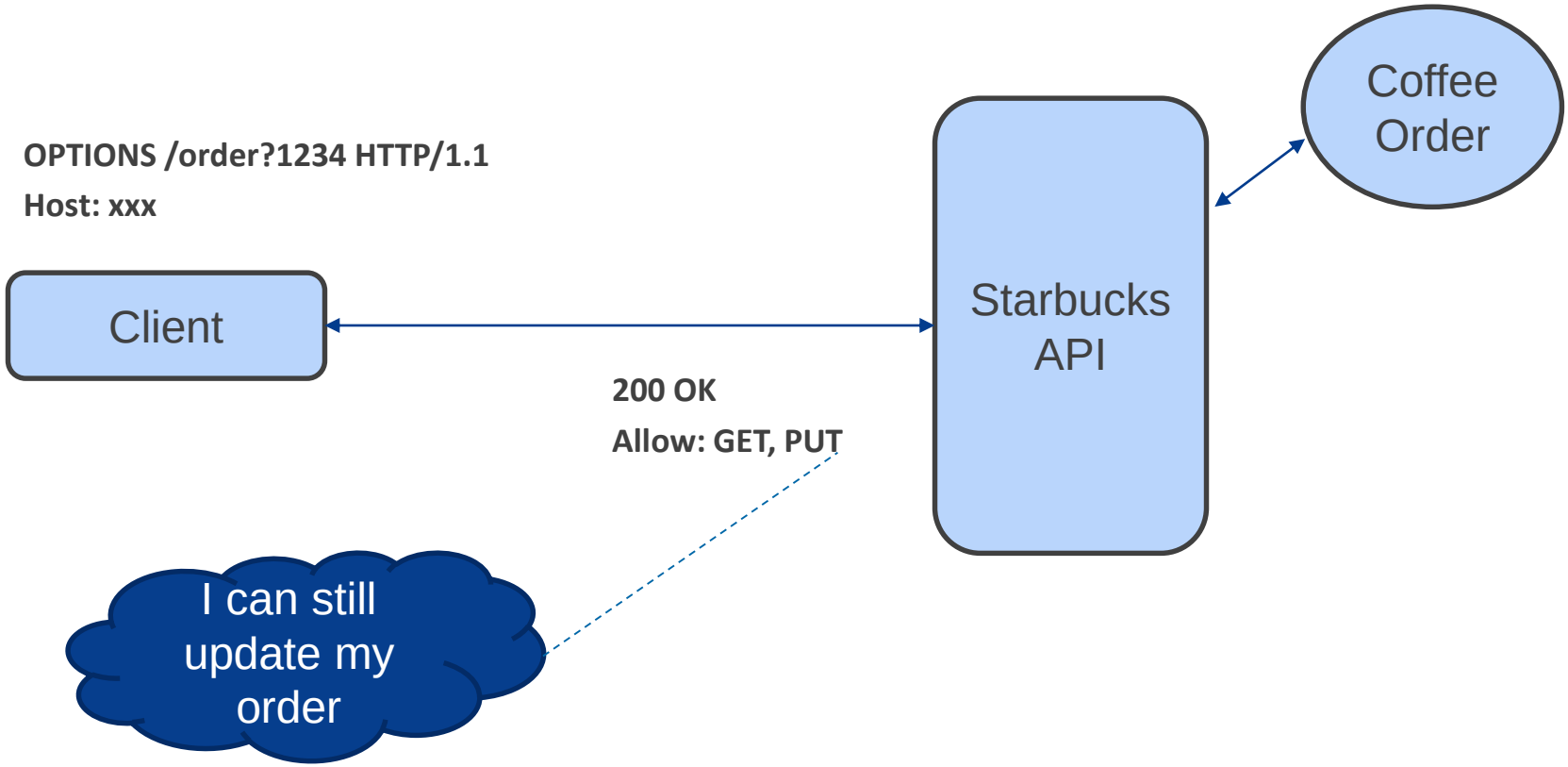
201 Created
Location: …/order?1234
Content-Type: application/xml

<order xmlns=urn:starbucks>
<drink>latte</drink>
<link rel="payment" href="…/payment/order?1234>
</order>

Oops ... A mistake!

I like my coffee to be strong

Need another shot of espresso, what are my OPTIONS?

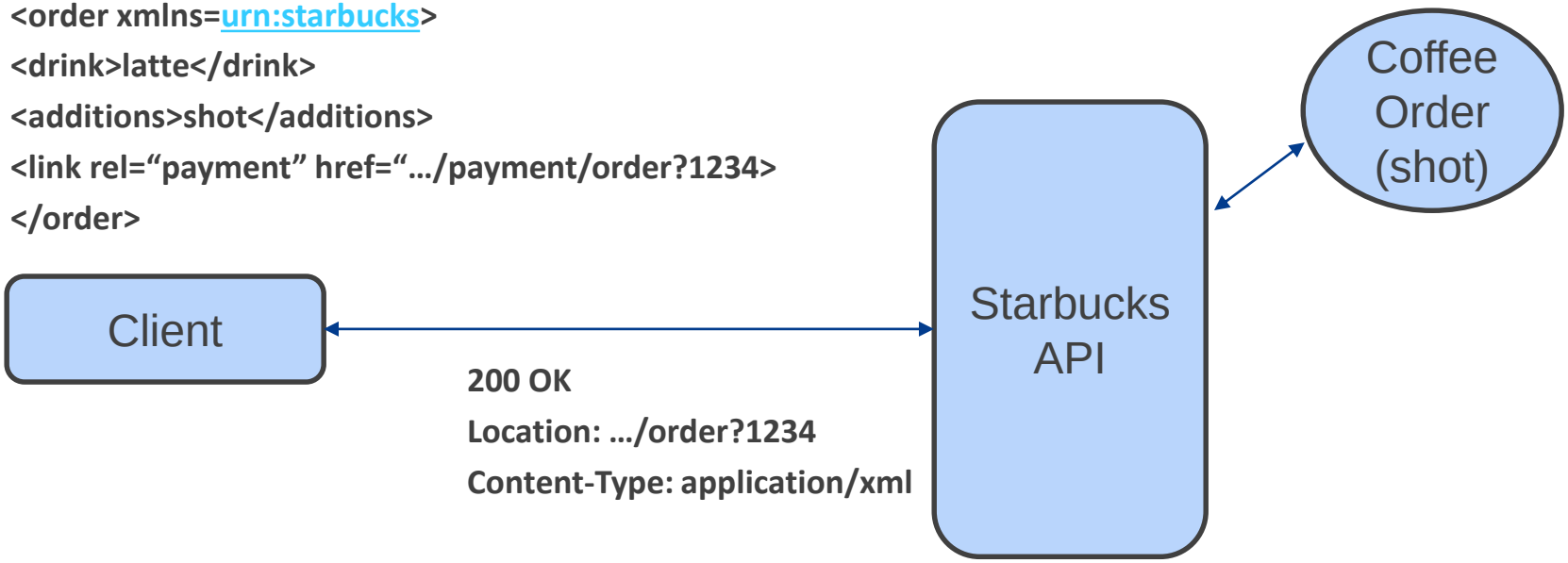


UNSW SYDNEY

Update the order

PUT /order?1234 HTTP/1.1
Host: xxx
Content-Type: application/xml

<order xmlns=urn:starbucks>
<drink>latte</drink>
<additions>shot</additions>
<link rel="payment" href="…/payment/order?1234>
</order>



200 OK
Location: …/order?1234
Content-Type: application/xml

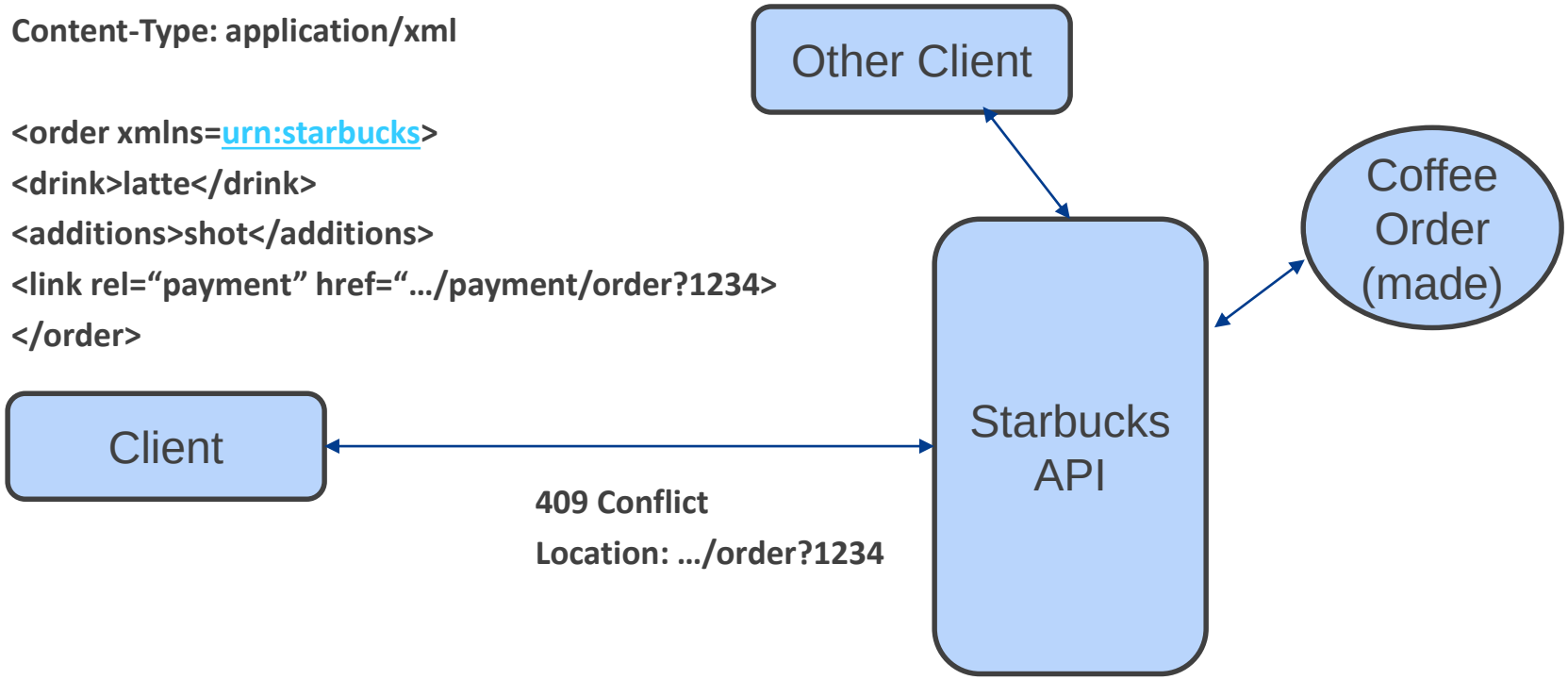
<order xmlns=urn:starbucks>
<drink>latte</drink>
<additions>shot</additions>
<link rel="payment" href="…/payment/order?1234>
</order>

Possible conflict with another workflow

The resource state can change without you … (before your PUT-ing getting to the server)

PUT /order?1234 HTTP/1.1
Host: xxx
Content-Type: application/xml

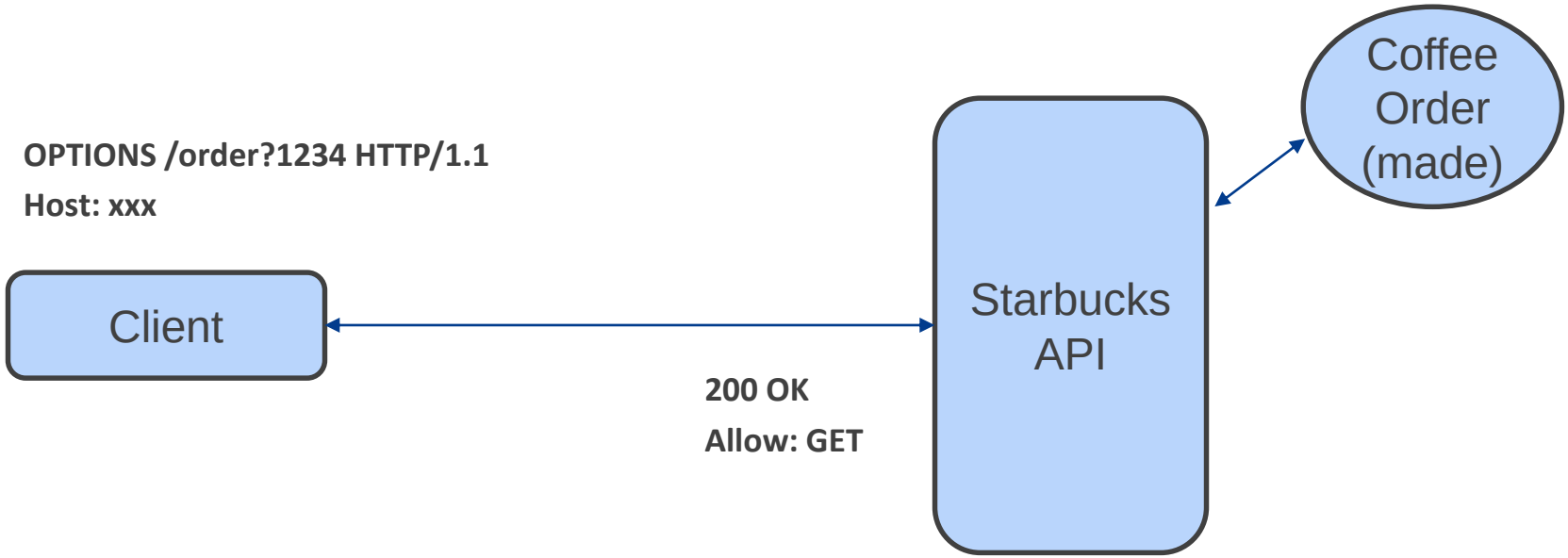
<order xmlns=urn:starbucks>
<drink>latte</drink>
<additions>shot</additions>
<link rel="payment" href="…/payment/order?1234>
</order>



Possible conflict with another workflow

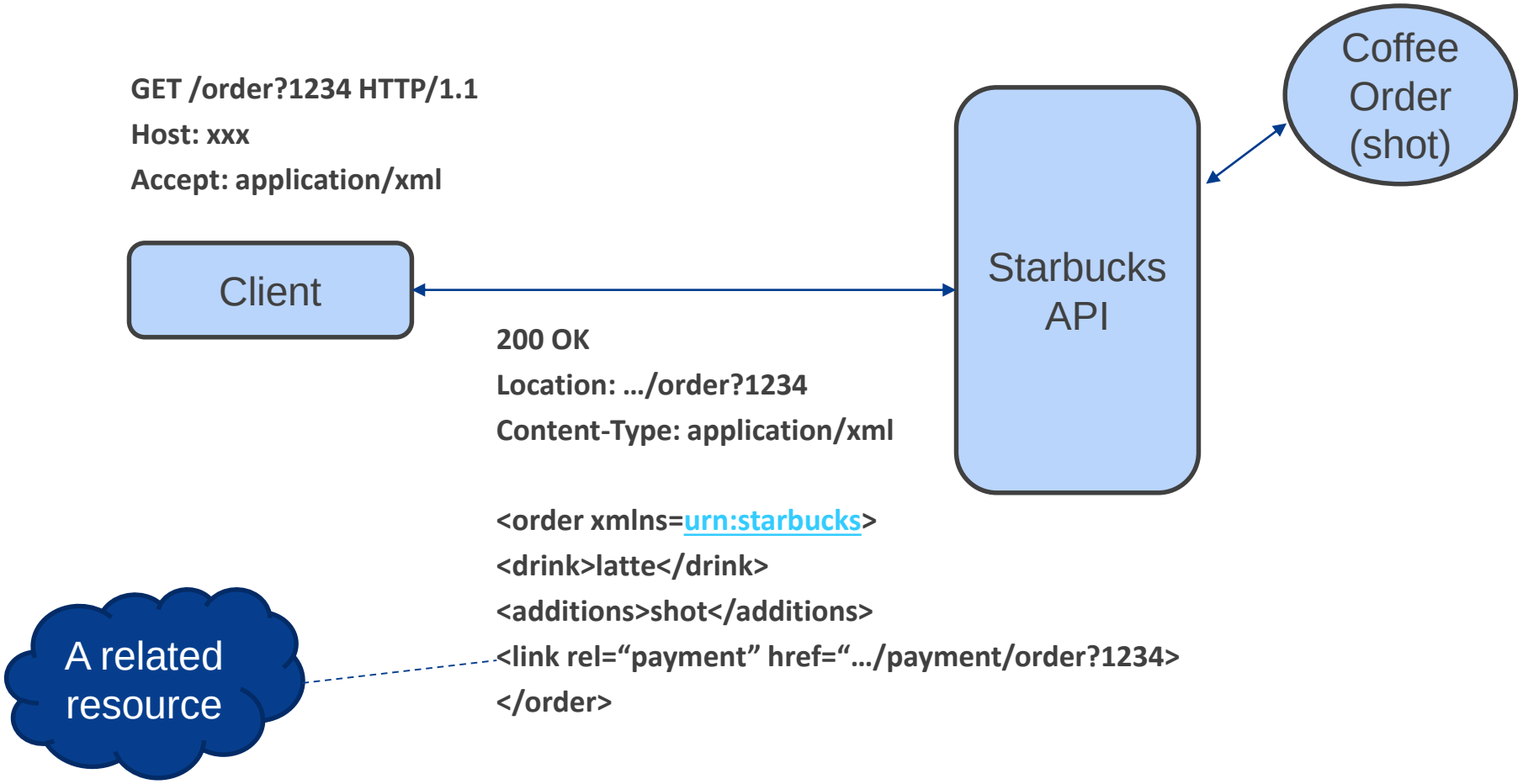
What are my OPTIONS now?

How do I recover?



OK, update successful, what now?

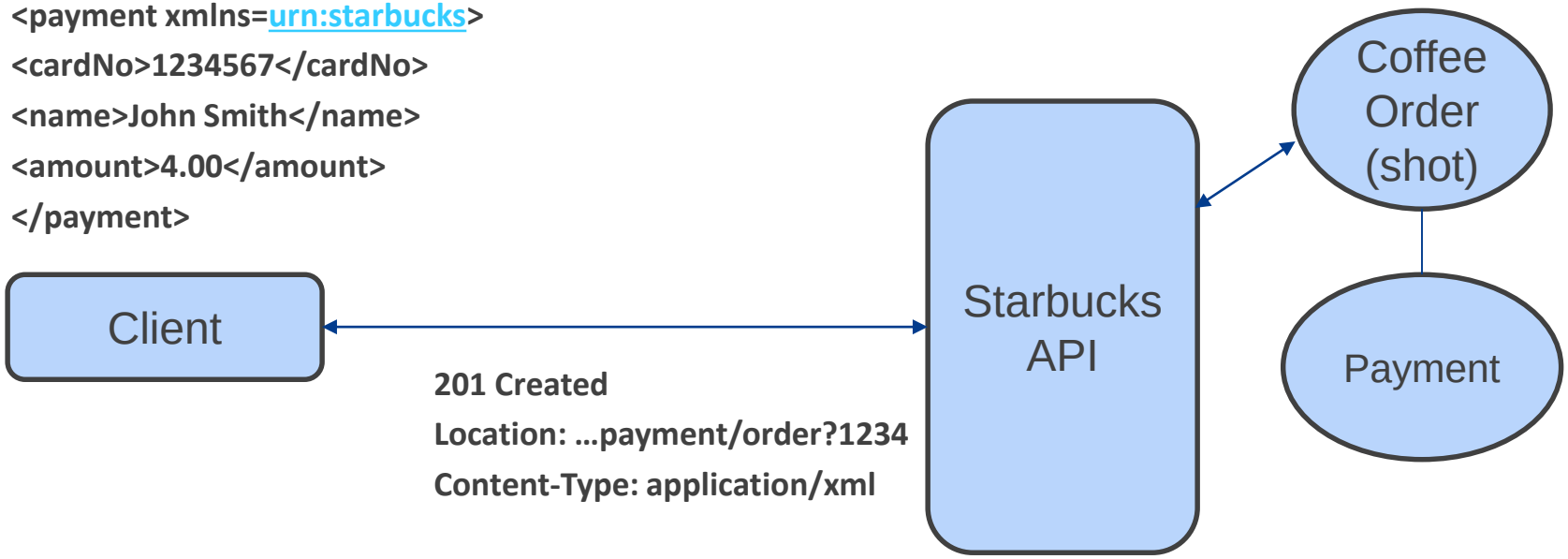
Idea floated here is … FOLLOW THE LINK.



Pay for the order (PUT = idempotent)

PUT /payment/order?1234 HTTP/1.1
Host: xxx
Content-Type: application/xml

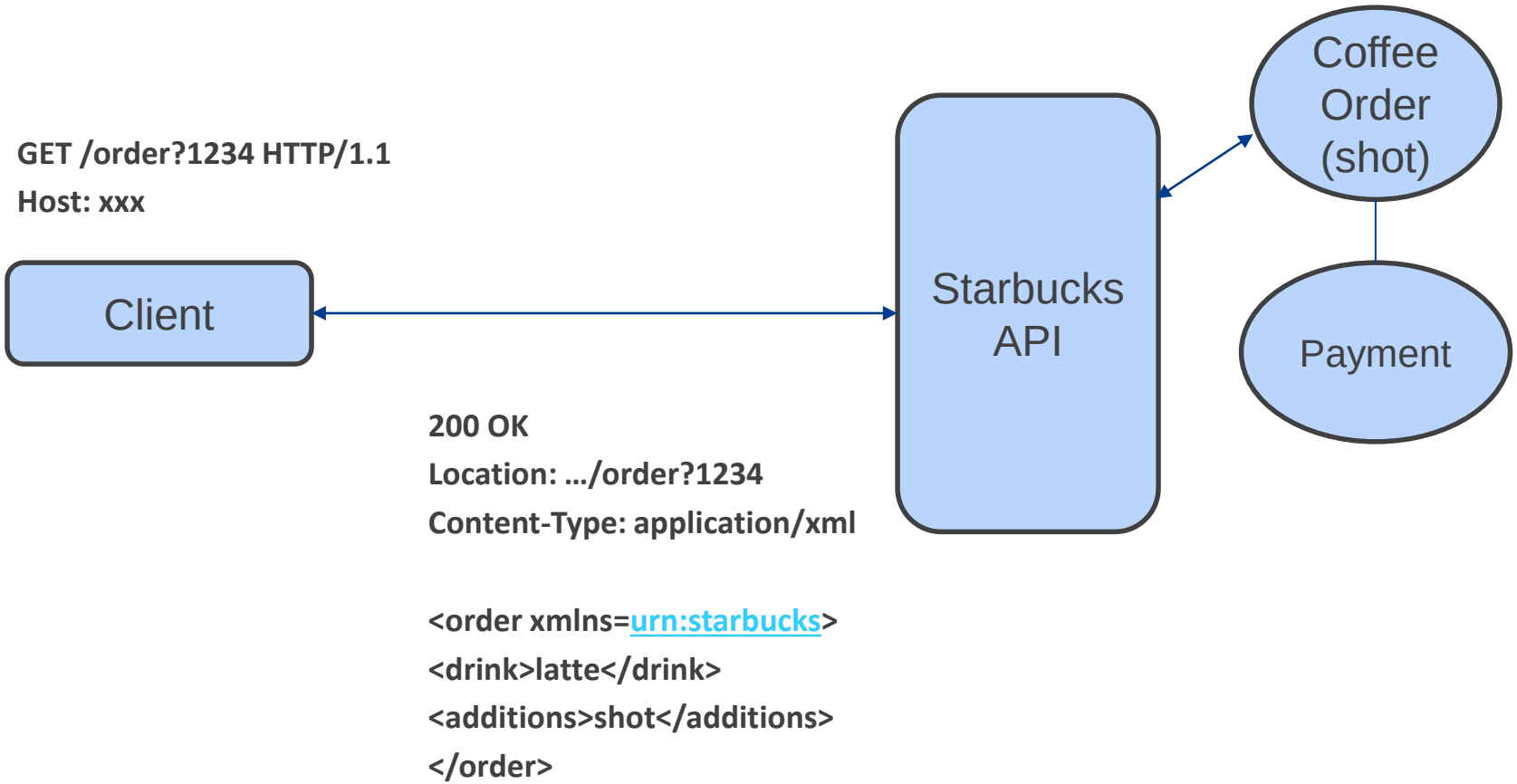
<payment xmlns=urn:starbucks>
<cardNo>1234567</cardNo>
<name>John Smith</name>
<amount>4.00</amount>
</payment>



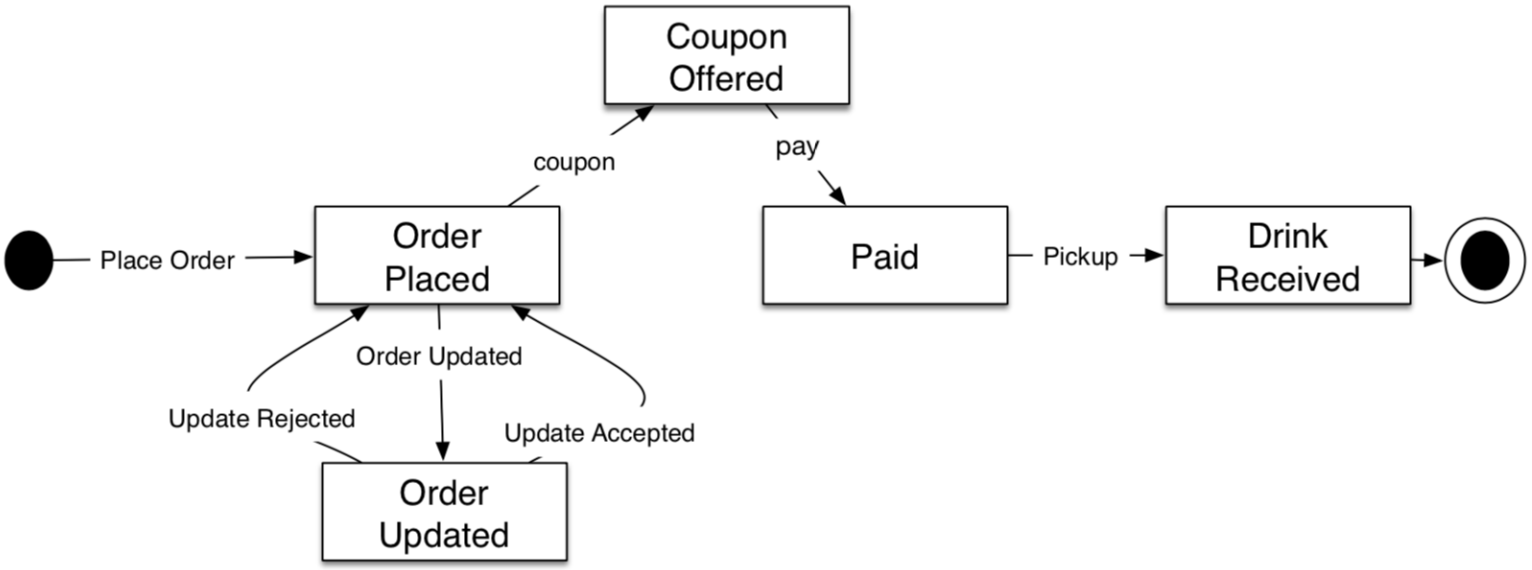
201 Created
Location: …payment/order?1234
Content-Type: application/xml

<payment xmlns=urn:starbucks>
<cardNo>1234567</cardNo>
<name>John Smith</name>
<amount>4.00</amount>
</payment>

Check that you have paid?



Changing the API conversation?



If the self-describing nature of the workflow (i.e., links) is well-respected, the client should not be surprised by the changes !

UNSW SYDNEY

Tools of the Trade

- Python
- Pandas
- Flask RESTPlus
- Swagger

UNSW SYDNEY

Flask and Flask RESTPlus

- **Flask** is a Python Micro Web Framework. It allows you to build light-weight Web Apps, but it has good capabilities because it support extensions (there are many)
- **Flask RESTPlus** is an extension for Flask that adds support for quickly building REST APIs. Flask-RESTPlus encourages best practices with minimal setup. It provides a coherent collection of decorators and tools to describe your API and expose its documentation properly (using Swagger).

UNSW SYDNEY

Swagger

- When using Flask RESTPlus, A Swagger API documentation is automatically generated and available on your API root but you need to provide some details with the Api.doc() decorator
- Swagger (now the "Open API Initiative) is a framework for describing your API using a common language that everyone can understand. Think of it as a blueprint for a house. You can use whatever building materials you like, but you can't step outside the parameters of the blueprint.
- Let’s have a look (http://editor.swagger.io)

UNSW SYDNEY

Questions?

UNSW SYDNEY